Intern. J. Neuroscience, 115:713–715, 2005
Copyright © 2005 Taylor & Francis Inc.
ISSN: 0020-7454 / 1543-5245 online
DOI: 10.1080/00207450590523936

Taylor & Francis
Taylor & Francis Group

Brief Communication

REDUCED LITTER SIZES FOLLOWING 48-H OF PRENATAL EXPOSURE TO 5 nT TO 10 nT, 0.5 HZ MAGNETIC FIELDS: IMPLICATIONS FOR SUDDEN INFANT DEATHS

M. J. DUPONT
G. PARKER
M. A. PERSINGER

Behavioral Neuroscience Laboratory
Laurentian University
Sudbury, Ontario, Canada

To test the hypothesis that a narrow intensity band of geomagnetic activity contributes to Sudden Infant Death, 32 pregnant rats were exposed for two to three days before expected parturition either to a coi1 that generated 0.5 Hz sine-wave, 5 to 10 nanoTesla magnetic fields, or to a reference coil (<1 nT) in the same room. The field was off for 30 min every 4 h during the exposure. The orientation of the coils was perpendicular in space and activated alternately in four blocks of experiments. The litters born to the exposed mothers contained significantly fewer pups (M = 14.1, SD = 2.1) than those exposed to the control conditions (M = 16.2, SD = 2.7). There were significantly fewer numbers of males and fewer numbers of females in litters exposed to the fields generated in the east–west and north–south directions, respectively. These results support the hypothesis that a specific temporal configuration of brief periods of geomagnetic activity can produce an increased incidence of nonvital fetuses, neonates, or infants.

Keywords geomagnetic activity, geomagnetic direction, magnetic fields, perinatal exposures, Sudden Infant Death, rats

Received 18 June 2004.

This research was supported from a grant from the Canadian Foundation for the Study of Infant Deaths (Sidney Segal Research Fund).

Address correspondence to Dr. M. A. Persinger, Behavioral Neuroscience Program, Department of Biology, Laurentian University, Sudbury, Ontario P3E 2C6 Canada. E-mail: mpersinger@laurentian.ca

Eckert (1992) hypothesized that combinations of geomagnetic and electromagnetic patterns might induce instabilities in neuronal circuits that disrupt cardiac or respiratory function that lead to Sudden Infant Death. O'Connor and Persinger (1997) found a strong, significant correlation between the incidence of Sudden Infant Deaths in Canada and specific bands of geomagnetic activity, particularly between 5 nT and 10 nT. Weanling rats that had been exposed perinatally to approximately 10 nT nanoTesla 0.5 Hz magnetic fields showed fewer neurons in the parasolitary nucleus in the brainstem if the field had been applied in the east–west but not the north–south direction (Dupont et al., 2004).

This experiment was designed to refine the previous experiment. It was assumed Sudden Infant Death reflected a general mammalian phenomenon. The authors predicted that if the correlation between 5 to 10 nT amplitudes of geomagnetic activity and these deaths reflected a causal process, then rats exposed to experimentally generated 5 to 10 nT, 0.5 Hz sine-wave magnetic fields should display this mortality. The 0.5 Hz pattern was selected because cells in the parasolitary nucleus respond to stimulation within this range (see Dupont et al., 2004 for references).

In four separate blocks of experiments over a one-year period a total of 32 Wistar albino pregnant females were exposed singly in plastic cages approximately two to three days before expected birth (as inferred by sperm plugs) to a coil in which a 5 nT to 10 nT 0.5 Hz sine wave was generated or to an orthogonally oriented, nonactivated coil in the same room. The field was generated in the E–W direction for two blocks and in the N–S direction for two blocks. A MEDA FM-300 magnetometer placed in the coil and coupled to a laptop computer maintained a continuous record of the geomagnetic and experimental fields. The latter field was discontinued for 30 min once every 4 h during the prenatal exposure. The induced field within the perpendicular coil employed as a reference in any given block was less than 1 nT. More details of the apparatus and procedures have been published elsewhere (Dupont et al., 2004).

Within 24 h of birth the numbers of males and females per litter were counted. A three way-analysis of variance within one within subject level (sex) and two between subject levels (no field, field; E–W vs. N–S direction), completed by SPSS software, showed that significantly [$F(1,28) = 5.80$, $p = .02$; eta-squared = .17] fewer ($M = 14.1$, $SD = 2.1$) rats were born to mothers exposed to the fields compared to the reference conditions ($M = 16.2$, $SD = 2.7$). The interaction between the orientation of the coil and the generation of fields was not significant [$F(1,28) = .13$, $p > .05$]. Although

there were no statistically significant differences between the numbers of females and males born and no significant interactions between field and sex and orientation of the fields and sex [Fs(1,28) < 2.00, $p > .05$], there was a statistically significant interaction [$F(1,28) = 6.22$, $p < .01$] between field presence, field orientation and sex.

The means and standard deviations for the numbers of pups for these conditions for the males were no field N–S 7.8 (2.1), no field E–W 8.5 (1.6), field N–S 8.2 (1.6), and field E–W 5.8 (2.3). For the females these values were: no field N–S 8.4 (2.0), no field E–W 7.9 (2.8), field N–S 6.1 (1.2), and field E–W 8.1 (2.2). Post hoc analyses by paired t-tests and Tukey's ($p < .05$) indicated that the major source of the interaction was due to the fewer numbers of male pups in litters exposed to the fields generated in the E–W direction and the fewer numbers of female pups in litters exposed to the fields generated in the N–S direction.

These results support the hypothesis that brief (48 h to 72 h) exposures to natural intensity (5 nT to 10 nT) geomagnetic fields whose frequency overlaps with neurons affecting respiration and vigilance can generate nonvital pups. Because pregnant females were randomly assigned to condition, artifact is unlikely. The mechanism for the average loss of 2 pups per average litter of 16 pups is unclear. Resorption within 48 to 72 h at this stage of development is not likely. If the pups were nonvital when born, the mothers may have eaten the pups before the litter sizes were counted. Direct effects on the mother's behaviors are not likely because infantophagia, when initiated, usually involves the whole litter.

REFERENCES

Dupont, M., McKay, B. E., Parker, G., & Persinger, N. A. (2004). Reductions in numbers of neurons within the parasolitary nucleus in rats exposed perinatally to a magnetic pattern designed to imitate geomagnetic continuous pulsations: Implications for Sudden Infant Death. *Perceptual and Motor Skills, 98,* 958–966.

Eckert, E. E. (1992). Magnetic influences on fetus and infant as reason for sudden infant death syndrome: A new testable hypothesis. *Medical Hypotheses, 38,* 66–69.

O'Connor, R. P., & Persinger, N. A. (1997). Geophysical variables and behavior: LXXXII. A strong association between sudden infant death (SIDs) and increments of global geomagnetic activity-possible support for the melatonin hypothesis. *Perceptual and Motor Skills, 84,* 1376–1378.

Copyright of International Journal of Neuroscience is the property of Taylor & Francis Ltd and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.